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Preserving Lebanon's coastal archaeology: Beirut, Sidon and Tyre

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Abstract

Lebanon is a key region in understanding the development and evolution of seafaring infrastructure and shipping, providing one of the richest and most continuous maritime archaeological records in the Mediterranean. Recent geoarchaeological work at Beirut, Sidon and Tyre has underlined the significance of studying this historical archive and the importance of preserving archaeological resources for the future. All three sites have a rich cultural heritage, both on land and at sea, and the aim of this paper is to precisely outline these areas and propose a protection plan for the immediate future.

1. Introduction

The sea has played a fundamental role in the history of the Phoenician coast. The Levantine seaboard served as an important communication interface between the ancient Near East and the Mediterranean and attests to a great antiquity of maritime activities [2,10,37,44]. Within this context, the Syro-Palestinian coast is a key region in understanding the development and evolution of seafaring infrastructure and shipping, providing one of the richest and most continuous maritime archaeological records in the Mediterranean [3,5,41,47,48,67,69,78]. Recent research has elucidated over 5000 years of human–environmental interactions, underlining the archaeological importance of Beirut, Sidon and Tyre in comprehending Bronze Age to Islamic period changes in technology, infrastructure and landscapes [52–56,58]. The study has facilitated the most sensitive archaeological zones to be identified, with a broad quantification of the archaeological resources available at each site. The idea of establishing a framework for the protection and management of Phoenicia's unparalleled coastal archaeology is one that must be addressed with some degree of urgency. Local (city councils), national (the Department of Antiquities of Lebanon) and international (Association Internationale pour la Sauvegarde de Tyr [AIST], Lebanese British Friends of the National Museum [LBFNM] UNESCO World Heritage Commission) agencies must work together on three areas: (1) to protect Beirut, Sidon and Tyre's exceptional archaeological heritage (see Ref. [15]); (2) to foster enhanced understanding of the importance of Phoenicia's cultural heritage; and (3) to facilitate participation in archaeology at the local, national and international levels. This includes projects to encourage local participation in the archaeological projects, and the development of cultural tourism as a source of durable development [27,30].

2. Lebanon and the Convention on the Protection of the Underwater Cultural Heritage (2001)

The Lebanon is presently undergoing rapid economic development exemplified by the urban regeneration and expansion of many of the coast's largest cities. This development needs to be undertaken within the context of a clearly defined cultural management program, and bygone mistakes made in Beirut's city centre should imperatively be avoided [43,46,62,63,70,76]. In January 2007, Lebanon accepted UNESCO's 2001 Convention on the Protection of the Underwater Cultural Heritage. At the time of writing, there were 15 member states party to the convention, 7 of which have seaboards on the Mediterranean and Black Sea areas (Bulgaria,

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Croatia, Lebanon, Libya, Romania, Spain and Ukraine). Significantly, Lebanon is the only Levantine state to have signed the convention. A complete list of the 35 articles defining this convention and its main objectives can be viewed at http://portal.unesco.org/en/ev.php-URL_ID=13520&URL_DO=DO_TOPIC&URL_SECTION=201.html.

Against this backcloth of increasing awareness *vis-à-vis* the importance of coastal and underwater archaeology, it is critical to review the archaeological and protection issues associated with the Lebanese coastline. Given that the country can effectively manage its underwater cultural heritage in accordance with the high standards outlined by UNESCO [16,17], we believe that it could serve as a model for neighbouring countries to follow. It is important to emphasize that the Levantine seaboard is the cradle of maritime technology, with arguably the longest and most complete maritime archaeological record in the Mediterranean.

The resources at Beirut, Sidon and Tyre can be divided into two main categories: buried onshore remains (silted up harbours, buried shorelines, buried maritime infrastructure and wrecks) and offshore archaeological contexts (wrecks and drowned land surfaces). Each location has a distinct range of research, management and conservation issues connected to it [25,45,79]. Of the three sites, only Tyre is listed on the UNESCO World Heritage list for the importance of its historical remains (since 1984).

3. Maritime infrastructure (harbour scale)

The areas surrounding the present seaports are rich in buried archaeological monuments and relics, bearing witness to a complex history of human occupation spanning some 5000 years. Using a multi-disciplinary geoarchaeological approach, recent study has enhanced understanding of the development of dock and harbour installations. We have identified a number of important waterfront areas (Figs. 1–3), significant in comprehending the evolution of maritime infrastructure and the expansion of shipping activities along the Levantine seaboard from the Bronze Age onwards [52–56,58]. The heart of Beirut, Sidon and Tyre's main anchorage havens today lie landlocked in the city centres, buried beneath the tracts of coastal sediment. For example, the harbours of Sidon and Tyre currently lie ~100–200 m from the present waterfront. As recent excavations at Marseilles [38–40] and Naples [32] have demonstrated, these sediments are not only rich historical archives key to understanding how ancient societies modified the coastal environment, but the fine-grained silts and sands also offer high preservation potential for the survival of Bronze and Iron Age harbourworks. At present, more research is required on the installations relating to the construction and provisioning of ships in antiquity, and their evolution through time. Much of the present research is centred on comprehending the impact of Bronze Age harbourworks and evolution

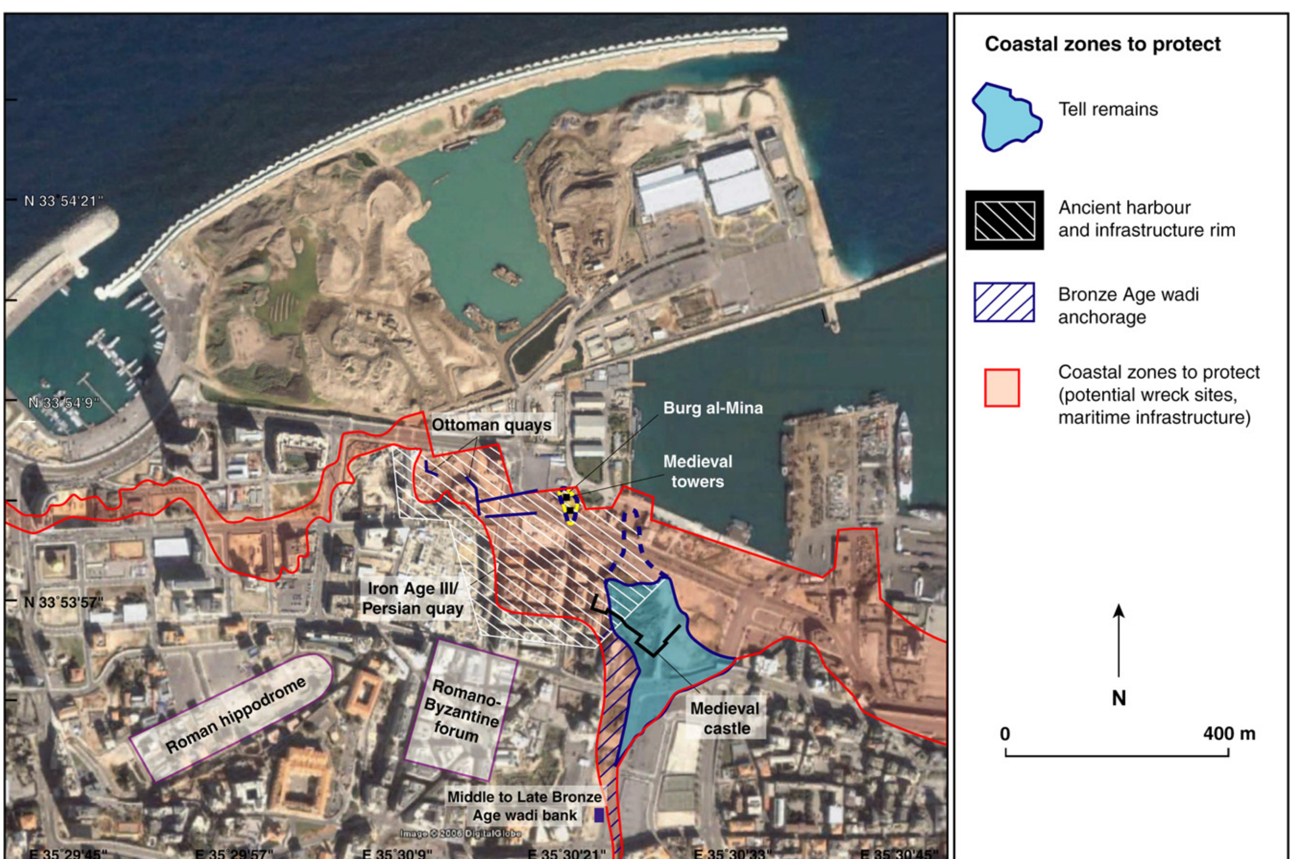


Fig. 1. Beirut's ancient coastlines and areas of archaeology to imperatively protect (base image: DigitalGlobe, 2006). Archaeological data from Elayi and Sayegh [20] and Marquis [49].

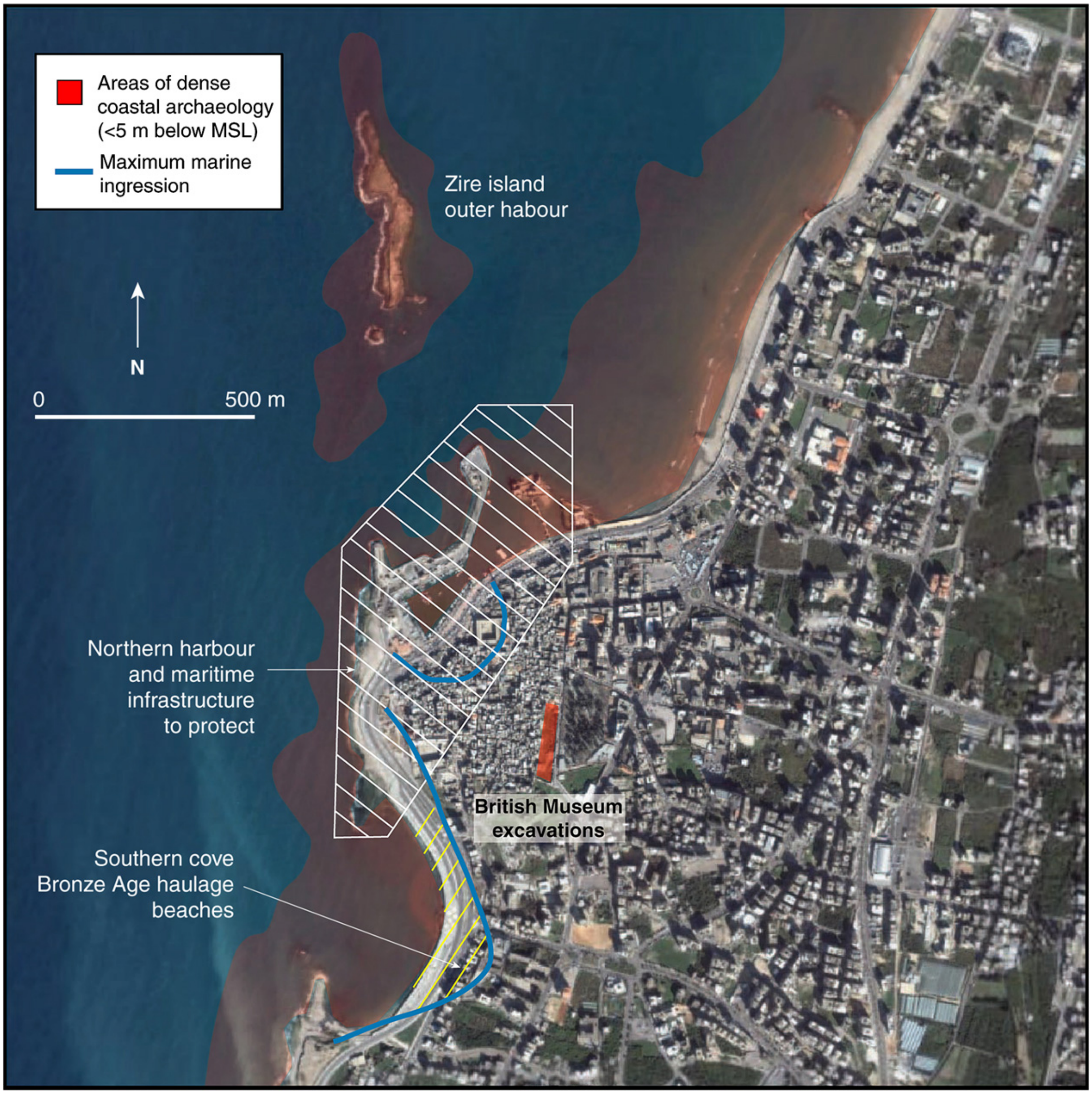


Fig. 2. Areas showing rich potential for coastal archaeology at Sidon (base image: DigitalGlobe, 2006).

from natural to artificial seaport infrastructure during the Bronze and Iron Ages. Keys to understanding this include the identification of moles, seawalls, shipyards, entrepot facilities and so forth. The silted up harbours of all three cities offer exceptional research potential to better apprehend these relationships. For example, at Tyre we estimate that an area of 32,500 m^2, beneath the present city market has the potential to provide rich archaeological information. While we have clearly linked certain stratigraphic facies to technological changes [54,57], there is a relative dearth of data pertaining to the precise nature of these harbourworks at all three sites. At present, only Beirut's silted harbour has yielded Iron Age harbour quays [20], ~300 m from the present waterfront. Offshore at Tyre, Noureddine and Helou [64] and Descamps (personal communication) have surveyed the northern Roman harbour mole, detailing its archaeological potentiality. Future research should focus on clearly identifying the nature of these archaeological resources.

3.1. Recommendations

In keeping with the goals of the 2001 UNESCO convention, all three ancient harbours must be protected by national legislation (e.g. land use planning); recent work has allowed us to precisely delimit the harbour areas for protection. One of the chief concerns is to marry urban development with the archaeology, so that the rich historical heritages of Beirut, Sidon and Tyre are integrated into the urban fabric. New construction permits should not be granted in these sensitive zones until the archaeological scope of the plot/site has been fully

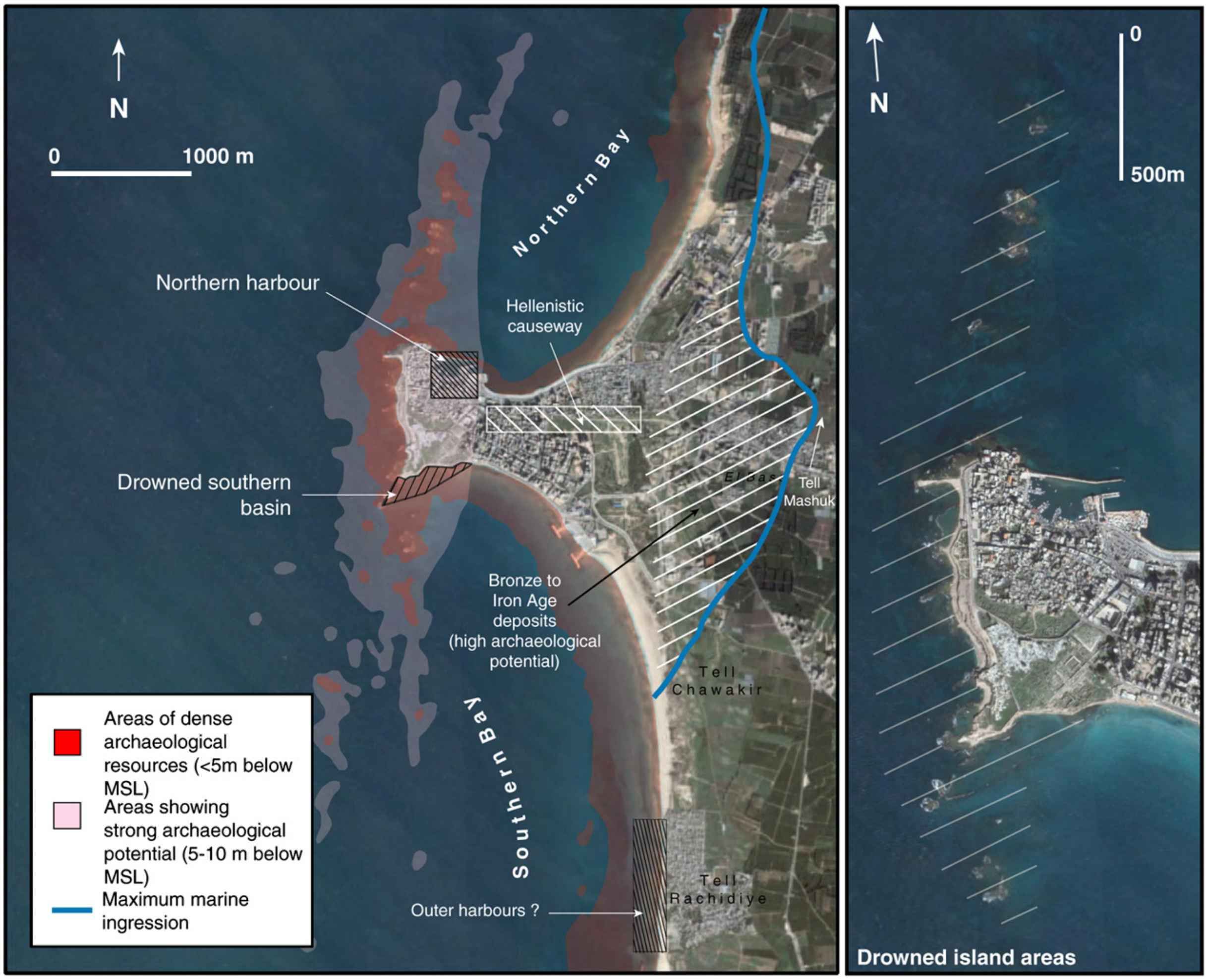


Fig. 3. Areas showing rich potential for coastal archaeology at Tyre (base image: DigitalGlobe, 2006).

investigated. In the event of significant artefacts being unearthed, the zone should be correctly excavated and recorded. Plots of major scientific importance must imperatively be protected from destruction, either by incorporating the archaeology into the proposed construction or preventing building of the plot. As a counter example, the recent modernisation of Sidon's ancient harbours completely ignored the impressive archaeological remains exposed at the site [26] (Fig. 4). These were amongst the best-preserved harbour structures on the Levantine seaboard (Fig. 5). Although not completely destroyed, they have been covered by concrete blocks while a more sustainable solution would have been to expose and accommodate these ancient structures into the new 550-m-long breakwater. Likewise, the southern harbour has been totally concreted by a modern 1-km-long promenade running from the Dakerman area in the south, around the southern Bronze Age bay, to the northern harbour (Fig. 6). This is despite Sidon being party to the UNESCO project 'Urban Development and Freshwater Resources: Small Coastal Cities' since 1997 (CSI unit). A decade on, many of the objectives of this protection program – advocating an integrated and sustainable development – have been largely ignored by urban planners and policy makers. On a much larger scale, similar mistakes were made at Beirut during the 1990s [46,62,63]. In reality, conservationists face stiff opposition and must vie with wealthy developers and politicians to protect the archaeological remains in these areas.

4. Submerged landscapes

Research at Tyre has shown the significant potential of Bronze Age to late Roman land surfaces surviving offshore (Fig. 3). These drowned landscapes have tremendous scope for the preservation of archaeological evidence and can potentially yield important insights into the nature, scale, and pace of the coastal change. Tectonic collapse has submerged significant tracts of the ancient island bastion, and we estimate that approximately 50% (or 470,000 m^2) of the former island is presently drowned $\sim$3 m below mean sea level [61]. While we have good constraints on the spatial dimensions of the island during antiquity, very little is known about the extent and condition of the archaeological remains. Frost [28] and El Amouri et al. [19] have revealed that Poidebard's proposed Egyptian harbour is in reality a drowned urban quarter of the ancient city. This southern basin, therefore, offers



Fig. 4. Since 1998, Sidon's northern harbour has been extensively modernised, destroying great tracts of the ancient harbourworks [50]. Better urban planning could have saved this unique cultural resource (base image: DigitalGlobe, 2006).

exceptional research and heritage potential. The shallow nature of its archaeology (around 3 m) means the area could be transformed into an underwater archaeology museum. Guided diving tours and the use of glass-bottom boats are viable solutions to expose the underwater archaeology to the general public. Not only does this have direct cumulative ramifications for the local economy, but it would also be an effective means of policing the area and generating funds for future research.

Recent underwater surveys by Descamps and colleagues suggest that significant Hellenistic, Roman and Byzantine remains also lie to the north of the Sidonian harbour, on the sandstone ridge's presently drowned northern extension (Descamps, personal communication). This ridge runs for some 1400 m from the northern tip of the island. During antiquity, exploitation of the most distal reefs as outer harbours offers scope for the understanding of maritime infrastructure. Unlike archaeology on the present peninsula, these remains have been relatively unaffected by medieval and modern constructions. At present, there are two major threats to the long-term survival of these underwater resources:

(1) *Looting by clandestine divers and treasure hunters*: the rich archaeological resources around Tyre have long been known to local divers. It is impossible to estimate the amount of archaeological material that has already been lost or removed from its primary context due to this activity and the sale of artefacts on the black market. To set this in context, statistics suggest that up to 60% of submerged archaeological objects in nearby Israeli waters have been recovered and lost to private collections [7]; and
(2) *Erosion*: coastal erosion not only undermines the preservation of archaeological resources, but storm and high swell can also expose tracts of archaeology to divers.



Fig. 5. Photograph of the aealionite breakwater at Sidon before its destruction to accommodate the northern harbour's new mole (photograph, C. Morhange, 1998).

4.1. Recommendations

Like Alexandria (Egypt), there is a clear need for government and international institutions, in collaboration with local and international academics, to take responsibility for the recording and protection of Tyre's drowned archaeological remains [23,24,35,36]. For example, since 1994 archaeologists from the Centre d'Etudes Alexandrines have endeavoured to systematically record more than 3000 objects (statuary, sphinxes, columns and blocks) around the underwater site of the ancient Lighthouse of Pharos [23,24]. Several important pieces have been raised and restored for public display [36]. Similar resources have also been unearthed at Sidon, in the vicinity of Zire island [8,9,29]. Greater understanding of the taphonomy of underwater deposits is also required, improving our comprehension of the survival of artefacts and the impacts of erosion and clandestine divers. We have drawn a series of 'sensitivity maps' for all three sites, identifying the cities' areas of high archaeological potential (Figs. 1–3). It is proposed that coastal areas down to a depth of 5 m be protected at Beirut, Sidon and Tyre. These areas must imperatively be better surveyed for their archaeology and correctly policed to avoid the further loss of historical resources. The immediate task is to set in place measures that in the long- and short-term



Fig. 6. Photograph of the promenade rimming the southern bay at Sidon. This infrastructure overlies areas of probable Bronze to Iron Age coastal archaeology (photograph C. Morhange, 1998).

will actively discourage the destruction of underwater cultural heritage, starting at a grassroot local level (in schools, public awareness programs, etc.). This does not entail preventing public access to the underwater resources, but rather more correctly policing the most sensitive areas and regularly surveying them to record new areas of archaeology exposed by erosion. Education and public participation must try to change public attitudes and encourage community participation. Although this is already done to a certain extent, national and international agencies must liaise more closely with local fishermen to record any archaeological material they have recovered. A reward system might also encourage new sites to be revealed to the authorities.

5. Wrecks

As concur other maritime sites on the Levantine coast, the possibility of unearthing Bronze Age to Islamic period wrecks in the area of Beirut, Sidon and Tyre is high [71,75]. Shipwrecks are of great significance in cultural and trading studies, as they comprise sealed and well-dated artefactual assemblages [6,11,65]. Recent archaeological work at Istanbul, Naples and Marseilles reveals the high preservation potential of harbour silts in conserving wooden hulls over many millennia [32,33,38,59,66,73]. For example, excavations at the site of Yenikapi, on the southern side of the Istanbul peninsula, have recovered at least 22 boats from the fine-grained harbour sediments [73].

Urban planning policy permitting, there is no immediate threat to these wooden structures in city centres although care must be taken when drilling down for deep foundation works. The question of offshore wrecks is more delicate, as these can be degraded by both erosion and clandestine divers. For the Lebanese coastline there are no precise figures, however statistics from France suggest that of the 600 wreck sites recorded by the French authorities only around 5% of these remain untouched [7]. Clearly, even when wreck sites have been identified, it is very difficult to protect and police these areas. Archaeologists must therefore focus upon extracting the maximum amount of data in relatively short time periods (see Ref. [31]).

5.1. Recommendations

Drawing on the example of DRASSM (Département des recherches archéologiques subaquatiques et sous-marines), we recommend government agencies liaise with local fishermen to establish a database of wreck sites along the coasts of Beirut, Sidon and Tyre. In the wider context of the Levantine basin, maritime archaeology would greatly benefit from a regional program of protection and collaboration, perhaps within the framework of the 2001 UNESCO convention. There is a clear need for complete appraisal of all known wrecks in the region, and where necessary new protection must be put into place. Just south of Tyre, on the Carmel coast, 26 shipwrecks have been located in the Dor/Tantura lagoon with an additional five at Akko (Kahanov, personal communication). Silted up ancient harbours offer exceptional opportunities to preserve ancient wrecks and excavate these using classic dig techniques. It is essential that any construction work at Beirut, Sidon and Tyre be evaluated for the survival of such wrecks. Offshore, attempts should be made to protect known wreck sites and extract the maximum amount of historical and archaeological data. Based on geoarchaeological data, we propose that marine bottoms down to a depth of 5 m be imperatively protected at all three sites [50,51,60]. In reality, underwater surveying at offshore sites is very costly and yields much poorer results than similar studies undertaken on *terra ferma* (see the impressive results obtained at Marseilles and Naples [32,33,39,40,66]).

6. Phoenicia's changing coastline

Our coastal reconstructions indicate that Beirut, Sidon and Tyre's coastlines have changed significantly during the past 6000 years [52,55,56,58] (Fig. 7). The core networks have detailed the historic pattern of coastal change within all three harbours. At Tyre, we have reconstructed the greater subaerial extension of the island breakwater, its evolution through time and the phases of accretion and progradation of Alexander the Great's isthmus [58]. The presence of this causeway means that the most pronounced coastal changes have taken place at Tyre, with the accretion of a 1.5 km $\times$ 3 km spit linking the former island to the adjacent shoreline. At Beirut and Sidon, research has identified the position of historic coastlines and their evolution since the maximum marine ingression. Archaeological data from Beirut, for example, indicate that the Bronze Age shoreline lies 300 m from the present seaport waterfront [20,49]. A broad tendency of silting up and coastline regularisation is observed at all three sites. Within the three cities' silted up harbours, this explains the distribution of archaeological resources. A general seaward shift in the archaeology from the Bronze Age onwards is due to loss of accommodation space.

At Tyre, we have elucidated the probable existence of extensive areas of Bronze and Iron Age maritime archaeology around Tell Mashuk, Tell Chawakir and Tell Rachidiye. Geophysics would be a rapid and cost-effective means of better constraining the nature of archaeological resources in this area. Fine-grained deposits to the west of Tell Mashuk offer high preservation potential. Between Tell Chawakir and Tell Rachidiye, a complex system of sand dunes is observed; these aeolian and coastal sediment tracts contain important amounts of archaeology. Sand dunes are complex geomorphological entities prone to instability and sudden large-scale shifts, with implications for recognising, dating and conserving archaeological resources around these tell sites. There is a need for further research on the geomorphology of the sand dunes to better comprehend the distribution of archaeological resources. As demonstrate the exhumed Roman and Byzantine remains on Tyre's tombolo, the archaeological scope of the isthmus is also significant.

6.1. Recommendations

We have elucidated a history of long-term coastal change at all three sites that has greatly advanced understanding of

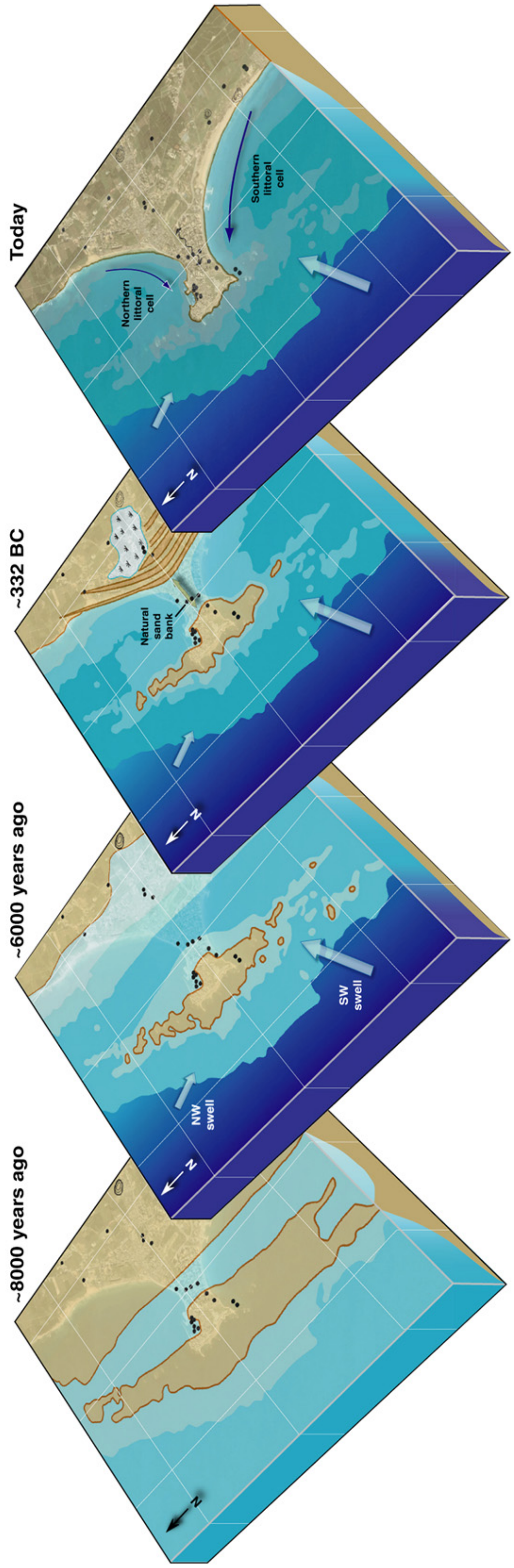


Fig. 7. Evolution of Tyre's coastline during the past 8000 years (black dots denote core sites).

the cities' archaeological resources. Many Bronze to Iron Age waterfronts at Beirut, Sidon and Tyre are landlocked hundreds of metres from the present coastlines. At Tyre, late Roman tectonic subsidence [21,61] is also responsible for the drowning of former land surfaces (∼50% of the ancient island). Preliminary surveys by Descamps and colleagues suggest that these are very rich archaeological archives. Future archaeological work could use this evidence to pinpoint and protect the areas of greatest research potential [60]. As in the silted up harbours, construction work might attempt to accommodate archaeological findings so as to ensure their long-term protection.

7. Exhibition of Phoenicia's archaeological heritage

7.1. Land based

On land, the cultural resources of Beirut, Sidon and Tyre are much easier to manage and present to the public than offshore. In keeping with the goal of UNESCO's 'Convention on the Protection of the Underwater Cultural Heritage', which advocates '*the public's right to enjoy the educational and recreational benefits of responsible non-intrusive access to in situ underwater cultural heritage, and of the value of public education to contribute to awareness, appreciation and protection of that heritage*', we suggest the following ideas:

(1) *Exhibition*: Using museum-based displays can be an important means of communicating a message to the public. Some of the material excavated at all three sites is today exposed at the National Museum in Beirut, however, neither Sidon nor Tyre possess exhibition centres at present. Examples from Europe show the scope of what can be achieved [1,4,12,13,34,72,74]. Sites as important as Sidon and Tyre should have their own museums, displaying the most important findings. This is clearly a project for the future, already envisaged by non-governmental organisations such as the Association Internationale pour la Sauvegarde de Tyr. Plans are presently being drawn up for a maritime museum in Alexandria's ancient harbour, demonstrating the scope of what can be achieved (http://www.linternaute.com/video/savoir/un-musee-sous-marin-a-alexandrie).

(2) *Data dissemination*: Layman books and internet sites are effective means of arousing public interest at an international level. At the local level, information pamphlets, brochures and site guides are also important in diffusing site details and serve as introductions to the descriptive history. The recent discoveries at Sidon have, in this respect, been well diffused thanks to the efforts of the Lebanese British Friends of the National Museum in collaboration with the British Museum and the Department of Antiquities. The dissemination of results is an important means of encouraging local and international stakeholders to protect the cities' archaeological heritages. Internet sites can be freely accessed by groups around the globe and serve as useful bridges to further information. Within this context, the archaeological results from Beirut and Sidon have been widely published in both local and international journals [14,15,20], and at Sidon a book for the lay public is currently in production. This area has not been correctly exploited at

Tyre, and information regarding the archaeology of the ancient city and its important cultural resources is not readily accessible.

(3) *Land-based trails*: The use of signs and information boards is a practical means of touching a wide cross-section of the public. For example, the strategic placement of information boards around the ancient harbours of Beirut, Sidon and Tyre would not only inform the general public of the history of the local site, but also allows people to better comprehend the archaeological scope of certain areas. In reality, very few people realise that the heart of Beirut, Sidon and Tyre's ancient harbours are today landlocked beneath the city centres.

7.2. Marine based

Allowing divers access to underwater archaeology can be risky and must be coordinated through education and public relations [77]. Ampurias and Caesarea Maritima's underwater archaeological parks are examples *par excellence* of what can be achieved. At Caesarea, the sunken harbour covers an area of 200,000 m^2 [68] and authorities have devised four diving complexes with 25 stops of notable archaeological interest. Divers are furnished with waterproof guide books detailing trails which they can follow according to their diving experience. The advantage of diving and snorkelling in ancient harbours is that the archaeology lies in relatively shallow waters,

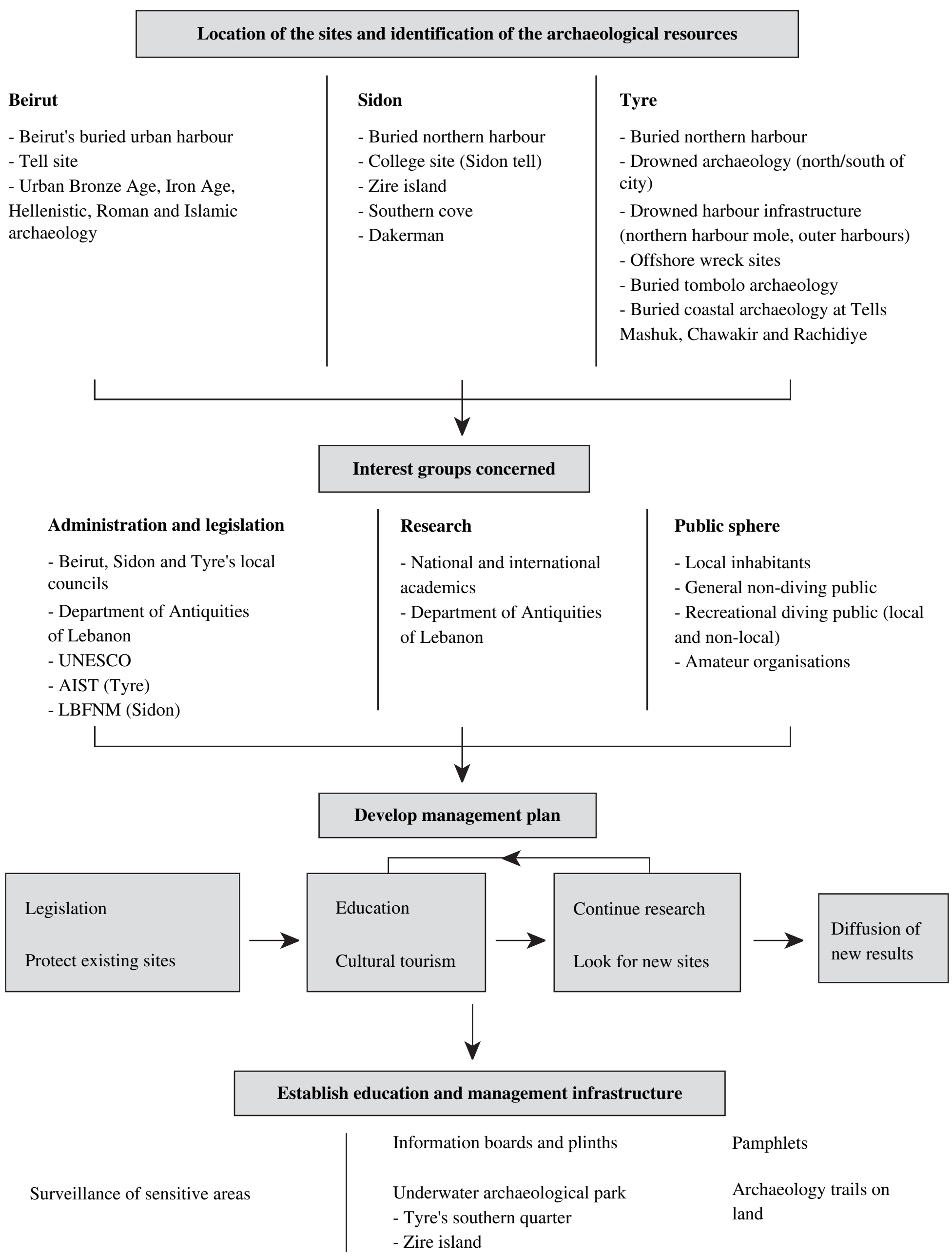


Fig. 8. Suggestions for the management of Beirut, Sidon and Tyre's coastal archaeology.

usually less than 4 m deep. Information sheets might provide general information on each site, guidelines on appropriate behaviour and sources for further information. Plinths and site markers can also yield additional information and provide a focal point for coordinating diving on the site [42]. At shallow water sites such as Tyre's southern basin (less than 3−4 m water depth), the scope for such a park is rich. For the non-diving public, glass-bottom boats can also be used to look at the underwater remains. One of the best examples is Baia near Naples. This drowned caldera, rich in maritime archaeology, can be visited by a glass-bottom vessel.

8. Conclusion

Beirut, Sidon and Tyre have a rich cultural heritage both on land and at sea (Fig. 8). One of the major problems facing cultural managers at these sites is how to change the attitudes of looters and the construction industry. Although government legislation does not suffice alone (see the counter example of Beirut city centre), there is a clear need for local institutions to implement some form of policy network to ensure the long-term stability of a cultural management process. The 2001 UNESCO Convention on the Protection of Underwater Cultural Heritage, which Lebanon is party to, provides a well-structured framework to aid in achieving this. In a similar vein, the program ArcheoMed (Patrimoine Culturel Maritime de la Méditerranée) is presently looking to establish an inventory of underwater archaeological sites and formulate a program of protection at the pan-Mediterranean level.

At sites such as Sidon and Tyre, the scope for a durable development plan based on cultural tourism is rich [30,22]. In Italy (Baia), Israel (Caesarea) and Spain (Ampurias) cultural heritage parks have been established with excellent results. Such parks not only encourage public access to the cultural resource, but also generate funds for preservation of the sites and future excavation programs. A management plan to suit the needs of the whole cross-section of society is required. The biggest threat to an underwater management program at Sidon and Tyre is the recreational diving public. While some individuals are extremely interested in archaeology and the preservation of the cities' underwater heritages, a majority of divers remove material out of ignorance or purposefully set out to loot sites for personal financial gain [18]. On the other hand, the local diving and fishing public have an enormous amount of knowledge that can potentially benefit an underwater management program. For example, they are often aware of sites unknown to the authorities. Liaising with these groups can be difficult for a number of reasons, although possible ways around it include the inauguration of a reward system. The Department of Antiquities and Lebanese government must take responsibility for the management of the three sites' cultural heritage, working closely with academics and organisations such as UNESCO. Ultimately the preservation of the sites will depend on the effectiveness of the management system, and should be headed by scientists with a good knowledge of their sites.

Acknowledgements

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